Health Consultation

Technical Document Review
Air Sparging/Soil Vapor Extraction Remediation System Design Report

Cadet Manufacturing Company
Vancouver, Clark County, Washington

EPA Facility ID: WAD009028879

February 2, 2004

Prepared by

The Washington State Department of Health
Under a Cooperative Agreement with the
Agency for Toxic Substances and Disease Registry

Foreword

The Washington State Department of Health (DOH) has prepared this health consultation in cooperation with the Agency for Toxic Substances and Disease Registry (ATSDR). ATSDR is part of the U.S. Department of Health and Human Services and is the principal federal public health agency responsible for health issues related to hazardous waste. This health consultation was prepared in accordance with methodologies and guidelines developed by ATSDR.

The purpose of a health consultation is to identify and prevent harmful human health effects resulting from exposure to hazardous substances in the environment. Health consultations focus on specific health issues so that DOH can respond to requests from concerned residents or agencies for health information on hazardous substances. DOH evaluates sampling data collected from a hazardous waste site, determines whether exposures have occurred or could occur, reports any potential harmful effects, and recommends actions to protect public health. The findings in this report are relevant to conditions at the site during the time of this health consultation, and should not necessarily be relied upon if site conditions or land use changes in the future.

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Glossary

Acute	Occurring over a short time [compare with **chronic**].
Agency for Toxic Substances and Disease Registry (ATSDR)	The principal federal public health agency involved with hazardous waste issues, responsible for preventing or reducing the harmful effects of exposure to hazardous substances on human health and quality of life. ATSDR is part of the U.S. Department of Health and Human Services.
Aquifer	An underground formation composed of materials such as sand, soil, or gravel that can store and/or supply groundwater to wells and springs.
Chronic	Occurring over a long time (more than 1 year) [compare with **acute**].
Contaminant	A substance that is either present in an environment where it does not belong or is present at levels that might cause harmful (adverse) health effects.
Dermal Contact	Contact with (touching) the skin (see route of exposure).
Environmental Protection Agency (EPA)	United States Environmental Protection Agency.
Exposure	Contact with a substance by swallowing, breathing, or touching the skin or eyes. Exposure may be short-term [**acute exposure**], of intermediate duration, or long-term [**chronic exposure**].
Groundwater	Water beneath the earth's surface in the spaces between soil particles and between rock surfaces [compare with surface water].
Hazardous substance	Any material that poses a threat to public health and/or the environment. Typical hazardous substances are materials that are toxic, corrosive, ignitable, explosive, or chemically reactive.
Indeterminate public health hazard	The category used in ATSDR's public health assessment documents when a professional judgment about the level of health hazard cannot be made because information critical to such a decision is lacking.
Ingestion	The act of swallowing something through eating, drinking, or mouthing objects. A hazardous substance can enter the body this way [see route of exposure].

Ingestion rate	The amount of an environmental medium that could be ingested typically on a daily basis. Units for IR are usually liter/day for water, and mg/day for soil.
Inhalation	The act of breathing. A hazardous substance can enter the body this way [see **route of exposure**].
Maximum Contaminant Level (MCL)	A drinking water regulation established by the federal Safe Drinking Water Act. It is the maximum permissible concentration of a contaminant in water that is delivered to the free flowing outlet of the ultimate user of a public water system. MCLs are enforceable standards.
Media	Soil, water, air, plants, animals, or any other part of the environment that can contain contaminants.
Model Toxics Control Act (MTCA)	The hazardous waste cleanup law for Washington State.
Monitoring wells	Special wells drilled at locations on or off a hazardous waste site so water can be sampled at selected depths and studied to determine the movement of groundwater and the amount, distribution, and type of contaminant.
Organic	Compounds composed of carbon, including materials such as solvents, oils, and pesticides that are not easily dissolved in water.
Parts per billion (ppb)/Parts per million (ppm)	Units commonly used to express low concentrations of contaminants. For example, 1 ounce of trichloroethylene (TCE) in 1 million ounces of water is 1 ppm. 1 ounce of TCE in 1 billion ounces of water is 1 ppb. If one drop of TCE is mixed in a competition size swimming pool, the water will contain about 1 ppb of TCE.
Plume	A volume of a substance that moves from its source to places farther away from the source. Plumes can be described by the volume of air or water they occupy and the direction they move. For example, a plume can be a column of smoke from a chimney or a substance moving with groundwater.
Remedial investigation	The CERCLA process of determining the type and extent of hazardous material contamination at a site.
Route of exposure	The way people come into contact with a hazardous substance. Three routes of exposure are breathing [inhalation], eating or drinking [ingestion], or contact with the skin [dermal contact].

Surface Water	Water on the surface of the earth, such as in lakes, rivers, streams, ponds, and springs [compare with **groundwater**].
Volatile organic compound (VOC)	Organic compounds that evaporate readily into the air. VOCs include substances such as benzene, toluene, methylene chloride, and methyl chloroform.

Background and Statement of Issues

The Washington State Department of Health (DOH) has prepared this health consultation report to summarize the results of its technical review of the Cadet Manufacturing Company (Cadet), *Air Sparging and Soil Vapor Extraction Remediation System Design Report*, dated October 2003. The report describes the design and operation of this subsurface remediation system, which was recently installed on Cadet's property.[1] DOH conducted its review because of the potential health concerns associated with the remediation system. DOH prepares public health consultations under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR).

The Cadet property is located at 2500 West Fourth Plain Boulevard in Vancouver, Clark County, Washington and is underlain by chlorinated solvent contaminated groundwater. The contaminated groundwater has migrated eastward to the Burlington Northern Santa Fe (BNSF) railroad tracks, northward between West 31st Street and La Frambois Road, and southeastward toward Port of Vancouver property.[2] The predominant chlorinated solvents found in groundwater include trichloroethylene (TCE) and tetrachloroethylene (PCE). Other chlorinated solvents, including 1, 1-dichloroethene (1, 1-DCE), have also been detected. The plume of contaminated groundwater underlies a significant portion of the Fruit Valley Neighborhood (FVN), which is east and north of the Cadet property.

Chlorinated solvents dissolved in groundwater can evaporate and move up through the soil and enter homes and other buildings, potentially exposing the occupants to these chemicals through the indoor air exposure pathway. The objective of the air sparging (AS) and soil vapor extraction (SVE) system, which Cadet has indicated is an interim remedial action measure (IRAM), is to reduce levels of TCE and PCE in groundwater below the Cadet property to target cleanup levels. Cadet developed the target cleanup levels, which are designed to be protective of residential indoor air, using the Johnson & Ettinger (J&E) vapor intrusion model.[1]

The potential public health concerns associated with the AS/SVE system compelled DOH to review the remediation system design report. DOH received the report on October 7, 2003, and was informed on October 10, 2003, that the remediation system would be started the week of October 13 or October 20, 2003.[3] System operation began October 23, 2003.[4]

It should be noted that DOH commented on this IRAM in May 2003 as part of its review of the work plan describing groundwater source control interim actions.[5, 6] DOH's comment letter is included in Appendix A. DOH received a 60% AS/SVE design document on September 11, 2003. However, the 60% design document was not reviewed by DOH because Cadet was already in the process of installing the system.

Discussion

Cadet's *Air Sparging and Soil Vapor Extraction Remediation System Design Report* describes the design and operation of the subsurface AS/SVE remediation system installed on the Cadet property. The system was designed to reduce levels of chlorinated solvents in groundwater,

which have the potential to volatilize and migrate into indoor air at buildings on and adjacent to the Cadet property. Theories about how AS/SVE systems work are well understood. However, it should be noted that the success of these systems in reducing volatile organic compound (VOC) concentrations in groundwater and soil is site-dependent.[7] Only limited data associated with the design of the Cadet AS/SVE system are presented in the report.

DOH identified some concerns during its review of the design report that make the success of the AS/SVE uncertain. Because of this uncertainty, it is unknown whether the system will adequately protect Cadet building occupants or nearby FVN residents from exposure to harmful levels of chlorinated solvents migrating from groundwater to indoor air. DOH's public health concerns are summarized below. Recommendations for addressing each concern are also provided.

1. **Section 3.1, Geology and Hydrogeology** – Figure 3 summarizes the thickness of surficial fine-grained soils, which are described as a homogeneous unit (i.e., sandy silt). However, when reviewing the boring logs presented in the draft remedial investigation report, these soils are actually heterogeneous, consisting of clayey silt, sandy silt, silty sand, sand (fine and medium grained), and occasional lenses of gravel.[8] Soil heterogeneity can reduce the effectiveness of the AS/SVE system resulting in the potential release of contaminants at and beyond the Cadet property boundary, potentially affecting indoor air quality.

   Recommendation – The heterogeneity of the upper soil unit should be considered when conducting future investigation, modeling, monitoring, and cleanup actions related to the Cadet site.

2. **Section 3.1, Geology and Hydrogeology** – The thickness of the upper fine-grained soil unit, described above, was incorrectly plotted on Figure 6, one of the geologic cross sections, according to the information presented on Figure 3.

   The water table level presented on Figure 6 represents the May 2003 water table. However, it would be more useful to know the maximum and minimum depth of the water table when evaluating the effectiveness of AS/SVE design.

   Recommendation – DOH recommends that Figure 6 be corrected to accurately depict the upper soil unit. Maximum and minimum water table levels should be plotted on the figure.

3. **Section 4.0, Remedial Action Objectives** – Cadet has selected target groundwater cleanup levels for TCE and PCE of 130 microgram/liter (ug/l) and 240 ug/l, respectively, which are intended to be protective of indoor air quality. These values were developed using the Johnson & Ettinger (J&E) vapor intrusion model and 1995 guidance. As DOH discussed in its comments on the Interim Action Work Plan – Groundwater Source Control, significant work on the vapor intrusion pathway has been conducted nationally since 1995 including release of the U.S. Environmental Protection Agency (EPA) draft vapor intrusion guidance and updates to the J&E model. DOH also recommended in its comments on the work plan that the Washington State Department of Ecology (Ecology) evaluate Cadet's vapor intrusion modeling approach since the groundwater cleanup levels obtained from this modeling are

being used by Cadet to make significant site decisions that could affect the health of the FVN community.[6] It should be noted that DOH has offered to assist Ecology with the vapor intrusion modeling results evaluation.[9]

It should also be noted that there is a lot of uncertainty associated with vapor intrusion modeling. Conducting concurrent groundwater, air, and soil gas sampling might reduce that uncertainty.

As DOH noted in May 2003, Cadet's proposed groundwater cleanup levels for TCE and PCE are well above the EPA's maximum contaminant levels of 5 micrograms per liter (ug/l).[6] Although groundwater at the Cadet site ("site" as defined under the Model Toxics Control Act (MTCA) cleanup regulation) does not appear to be a current source of drinking water, it is a potential future source based on criteria presented in MTCA cleanup regulation.

Recommendation –Ecology should provide DOH a summary of its J&E model evaluation. To address the uncertainty associated with the modeling, DOH recommends that Ecology ask Cadet to conduct concurrent groundwater, soil gas, and indoor air sampling to confirm that their predicted groundwater levels are, in fact, protective of indoor air quality at buildings above the plume.

Ecology should also consider establishing groundwater cleanup levels that are protective of the future drinking water source.

4. **Section 5.1, System Overview** – Figure C-1 (site map with existing features), shows a water line extending along the east side of the Cadet property. No information is provided to indicate where this line goes beyond the Cadet property. Also, there is no soil gas data available to demonstrate that the backfill associated with the water line is not acting as a preferential pathway for contaminant migration.

   Recommendation – DOH recommends that the water line backfill be tested to ensure that chlorinated solvent vapors are not migrating through the backfill and potentially affecting human health. Any soil gas data collected along the water line should be provided to DOH for review.

5. **Section 5.4.2, SVE Wells: Screen Depths and Designs** – The report indicates that the SVE well screens will be installed from 5 to 20 feet bgs (5 to 25 feet bgs along the eastern Cadet property boundary) and that the SVE well screens will penetrate into the sand unit below the sandy silt unit to provide greater assurance that the sparge vapors are fully captured. However, according to the geologic cross sections (assuming Figure 6 has been corrected); much of the sand unit appears to be saturated during a significant portion of the year.

   Recommendation – DOH recommends that groundwater, soil gas, and indoor air monitoring be conducted at an adequate frequency during the operation of the AS/SVE system to ensure that the system is effectively removing and capturing chlorinated solvents and does not pose a health risk to the Cadet building occupants or the residents in the nearby FVN. Ecology

should consider increasing the monitoring frequency during the winter months to ensure that chlorinated solvent vapors are being captured and not posing a health risk.

6. **Section 5.4.2, SVE Wells: Screen Depths and Designs** – The report does not address whether groundwater upwelling, which could occur when vacuum is applied to the SVE wells, was considered during the system design. Significant upwelling could prevent capture of solvent contaminated soil gas, which could affect human health if the soil gas migrates into indoor air.

   Recommendation – DOH recommends that upwelling in the SVE wells be monitored to ensure that well screens are available for capturing the chlorinated solvents volatilized from the groundwater. If significant upwelling is occurring that prevents contaminant capture, measures should be considered to offset the upwelling.

7. **Section 5.5, AS/SVE System Controls and Interlocks** – The report summarizes a number of potential situations where all or part of the AS/SVE system will automatically shutdown. Planned shutdowns are also possible. However, there is no information provided to indicate whether residents in the immediate vicinity of the AS/SVE system are at any health risk if such shutdowns occur.

   Recommendation – Potential health risks to FVN residents associated with AS/SVE system shutdown should be addressed. Plans to reduce or prevent such health risks, if they exist, should also be addressed.

8. **Section 7.2, Pressure Monitoring** – Nine locations have been identified as pressure monitoring locations, which will be used during the AS/SVE system start-up and on-going operation to evaluate whether the SVE system is operating as planned. These locations are all east of the Cadet building, near adjacent residential properties. Although there are no residential properties located immediately to the west, south and north of the Cadet AS/SVE system, vapors, if not captured, could migrate toward utility trenches or other structures as wells as to the portion of the FVN, north of Cadet. Lack of pressure monitoring points and accompanying data would prevent evaluation of possible health risks associated with the AS/SVE system.

   Recommendation – DOH recommends that Ecology consider additional pressure monitoring locations be established to the north, south, and west of the Cadet AS/SVE system to ensure that system is not posing a health risk.

Child Health Considerations

The Cadet AS/SVE system is planned to reduce groundwater chlorinated solvent concentrations to a level that will protect indoor air quality in the FVN. FVN is an area where children could potentially be exposed to chlorinated solvents migrating from contaminated groundwater to indoor air. Children may be uniquely vulnerable to the hazardous effects of environmental contaminants. Children breathe more air per pound of body weight than do adults resulting in

higher levels of exposure to contaminants in air. Additionally, the fetus may be highly sensitive to many chemicals, particularly with respect to potential impact on childhood development. For these reasons, DOH has determined that it is very important to consider the effects that cleanup remedies like the AS/SVE system may have on children, as well as other sensitive populations. DOH will continue evaluating these potential exposures as information becomes available.

Conclusions

The purpose of the AS/SVE system is to reduce levels of chlorinated solvents in groundwater, which have the potential to volatilize and migrate into indoor air at buildings on and adjacent to the Cadet property. Because of the outstanding issues and uncertainties regarding the AS/SVE system design and operation, as described above, this site is categorized as an indeterminate public health hazard.

Recommendations/Public Health Action Plan

1. DOH makes the following recommendations, which are described in more detail in the discussion section above:

   - Accurate geologic/hydrogeologic cross sections should be developed to reduce the uncertainty associated with remedial activities (e.g., investigation, modeling, monitoring, and remediation).
   - Ecology should provide information to DOH demonstrating that the vapor intrusion modeling conducted by Cadet provides groundwater cleanup levels that protect indoor air quality and thereby reduce potential public health exposures to contaminants in indoor air. This would include supporting sampling results.
   - Upwelling in the SVE wells should be evaluated to determine whether the well screens are available for vapor extraction.
   - The potential for the water line to act as preferential vapor pathways should be addressed.
   - The frequency of groundwater, indoor air, and soil gas monitoring should be re-evaluated, particularly for the winter months.
   - Risks to the FVN associated with the automatic and planned shutdown of the AS/SVE should be addressed.
   - Additional pressure monitoring points should be considered when evaluating the effectiveness of the SVE system to capture sparged air on the west, north, and south sides of the system.

   Action

   Ecology should provide written responses to DOH regarding the recommendations listed in this consult.

2. DOH recommends future remediation system design and operation/maintenance plans and reports be provided to DOH.

Action

Ecology should provide to DOH future remediation system design and operation/maintenance plans and reports well in advance of remediation system installation to allow DOH adequate time for reviewing and commenting on the documents.

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References

1. AMEC Earth & Environmental, Inc. Air sparging and soil vapor extraction remediation system design report, Cadet Manufacturing Company. Portland, Oregon: AMEC Earth & Environmental; 2003 October.

2. AMEC Earth & Environmental, Inc. Semi-annual groundwater monitoring report 2002. Portland, Oregon: AMEC Earth & Environmental, Inc.; 2003 February.

3. Washington State Department of Ecology. E-mail from Craig Rankine to Barbara Trejo, Washington State Department of Health, concerning Cadet project schedule. Olympia, WA, October 10, 2003.

4. Washington State Department of Ecology. Written comments from Craig Rankine to Barbara Trejo, Washington State Department of Health, concerning the draft health consultation report for the air sparging/soil vapor vacuum remediation system design report. Olympia, WA, November 13, 2003.

5. AMEC Earth & Environmental, Inc. Work plan for interim action for groundwater source control, Cadet Manufacturing Company. Portland, Oregon: AMEC Earth & Environmental; 2003 April.

6. Washington State Department of Health. Letter from Barbara Trejo to Craig Rankine, Washington State Department of Ecology, concerning interim action work plan for groundwater source control. Olympia, WA, May 28, 2003.

7. U.S. Environmental Protection Agency. How to evaluate alternative cleanup technologies for underground storage tank sites. U.S. Environmental Protection Agency; 1995 May.

8. AMEC Earth & Environmental, Inc. Draft remedial investigation report, Cadet Manufacturing Company. Portland, Oregon: AMEC Earth & Environmental; 2003 February.

9. Washington State Department of Health. E-mail from Barbara Trejo to Craig Rankine, Washington State Department of Ecology, concerning indoor air evaluation work plan. Olympia, WA, October 16, 2003.

Appendix A

Washington State Department of Health
Cadet Manufacturing Company Site
Comments on Interim Action Work Plan – Groundwater Source Control
May 28, 2003

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Certification

This Health Consultation was prepared by the Washington State Department of Health under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with approved methodology and procedures existing at the time the health consultation was begun.

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The Division of Health Assessment and Consultation, ATSDR, has reviewed this public health consultation and concurs with the findings.

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